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ABSTRACT

The lecture is the primary method used to teach many college-level courses, including teacher education courses. While the lecture has its place, genuine classroom discussions can engage diverse learners in meaningful dialogue with their peers and/or the instructor. Learning to use different communicative forms is essential to promoting the ideals of mathematics reform. If prospective teachers are to become good facilitators of classroom discourse, they must be exposed to various discursive models in methods courses. In this study, the debate model was used to conduct teacher research in a mathematics methods course. The findings show that debate encourages different types of responses, helps students to develop convincing arguments, and allows teachers and students to learn from one another. Additional research is needed to show how engaging in mathematical discussions in methods courses helps pre-service teachers to become good facilitators of mathematical discourse. (Contains 15 references.) (Author/YDS)

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FROM MONOLOGUE TO DIALOGUE:

Facilitating Classroom Debate in Mathematics Methods Courses

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Abstract. The lecture is the primary method used to teach many college-level courses, including teacher education courses. While the lecture has its place, genuine classroom discussions can engage diverse learners in meaningful dialogue with their peers and/or the instructor. Learning to use different communicative forms is essential to promoting the ideals of mathematics reform. If prospective teachers are to become good facilitators of classroom discourse, they must be exposed to various discursive models in methods courses. In this study, the debate model was used to conduct teacher research in a mathematics methods course. The findings show that debate encourages different types of responses, helps students to develop convincing arguments and allows teachers and students to learn from one another. Additional research is needed to show how engaging in mathematical discussions in methods courses helps pre-service teachers to become good facilitators of mathematical discourse.

FROM MONOLOGUE TO DIALOGUE:

Facilitating Classroom Debate in Mathematics Methods Courses

In this article, I present empirical data from a teacher-research study that describes how one group of mathematics education students responded when they were given the opportunity to facilitate and participate in a classroom debate. First, I discuss the importance of the teacher's role as the facilitator of classroom discussion and the debate model. Second, I present evidence from the debate itself to showcase the students as facilitators and then conclude with a discussion about how college educators can use the debate model to promote the ideals of educational reform.

Teachers as Facilitators

The reform movement in education, a response to *A Nation at Risk* (1983), is an impetus for change to remedy the low performance of U. S. students in critical fields like mathematics and science. The National Council of Teachers of Mathematics (NCTM) and the National Research Council (NRC) published *Standards* in mathematics and science, respectively. *The Professional Standards for Teaching Mathematics* (NCTM, 1991), *The National Science Education Standards* (NRC, 1996) and the *2061 Benchmarks* emphasize the importance of classroom discussion and the teacher as facilitator. These documents call for shifts "toward classrooms as...communities" (NCTM, 1991, p. 3) "and teachers as

producers of knowledge" (NRC, 1996, p.72). Orchestrating classroom discussions is one way that teachers can develop a community of learners.

For those teachers who want to facilitate meaningful dialogue with their students, orchestrating classroom discussion is not an easy task. Genuine discussions in the majority of U. S. mathematics classrooms remain rare since the cycle of "teacher-questioning, student-answering, and teacher-evaluating" is difficult to break (Cazden, 1988). Research studies in a variety of disciplines show that teachers have direct influence on classroom culture, which can result in active, controlled, or silent classroom discussions (Albert, 1987; Jegede & Olajide, 1995; Lampert, 1989; Tuyay, Jennings, & Dixon, 1995). Teachers must learn how to lead students in productive discussions (Leonard, 1999; Lo & Wheatley, 1994). They need to realize when to give information, when to clarify, when to model, when to lead, and when to let the students struggle to construct and understand important concepts (Ball, 1993).

If any educational setting reinforces the traditional style of teaching, it is higher education. The dominant form of instructional delivery is the lecture. Even in schools of education, prospective teachers may not get to participate in activities that actually model the kind of instruction they should use with students.

Classroom debate is one instructional strategy that instructors can use as an alternative to the lecture. Allen, Willmington, and Sprague (as cited in Worthen & Pack, 1992) claim that classroom discussion and student debate

improve critical thinking skills. Students are able to develop "the ability to analyze controversial statements; the ability to search out relevant information; the ability to test evidence and conclusions based on evidence; the ability to recognize underlying assumptions; the ability to draw and criticize inferences; and the ability to perceive reservations to inferences in argument" (p. 4-5).

Fostering the Environment

As a second year assistant professor of mathematics education, I decided to conduct teacher research on the use of classroom debate during the spring semester of 1998. I chose to have a classroom debate on the use of technology in mathematics classrooms and the use of constructivist teaching techniques. The rationale for choosing these topics was that they were controversial. The National Center for Education Statistics reported in 1994 that only 5% of fourth-grade teachers permitted unrestricted use of calculators. Constructivist teaching is based on the idea that students acquire knowledge by building upon prior experiences and not by passively listening to information and repeating it (Campbell & Johnson, 1995). I believed that the issues surrounding technology use and constructivist teaching would initiate a great deal of discussion.

The debate model was formatted after the television talk show. Students understand certain key elements of debate because of popular talk shows like *Jerry Springer*, *Montel* and *Oprah*. By watching these shows, students can learn how issues are raised, pro and con positions are taken, and how the audience

participates by asking questions and reacting to statements that are made. Having this popular knowledge (Banks, 1991), the students in my math methods course were eager to participate in the classroom debate on topics related to mathematics education.

Setting

The institution where I work is an urban research university in a large metropolitan city. The mathematics methods course is a three-credit course for junior and senior elementary education majors, and the class meets 2 hours and 50 minutes each week during the semester. The undergraduate students in the spring 1998 course (n = 30) were very diverse (43.3% African American, 3.3% Asian, 43.3% Caucasian, and 10.0% Latino). There were 5 males and 25 females in the class. The majority of these students were also enrolled in a Math/Science Practicum where they interacted with urban fourth-grade students several hours per week. Thus, many of the concepts they learned in the course could be directly applied in an educational setting.

Methodology

The students were told in advance that they would participate in two debates. The first debate was about the use of technology in mathematics classrooms, and the other debate was on the use of constructivist methods to teach mathematics. The students were totally in control of the debates. As the professor and researcher, my role was that of a participant-observer. One student agreed to

be the facilitator. Four students volunteered to serve as panelists and prepared to lead the discussions by reading current research on the topics. Another student volunteered to videotape the class as the students engaged in each discussion.

The class was divided into two sections, pro and con. The student facilitator initiated each debate by asking the panelists to present opposing views on each of the issues. She also invited other students in the class to respond to the panelists' positions. The frequency of student participation in each debate was obtained from the videotape.

Data Analysis

The data will be presented in two ways. First, the number of students who participated in each debate will be reported. Second, what the students' said in the debates raise many issues from calculator and computer use to teaching methodologies such as direct instruction, cooperative learning, and constructivist approaches. While all of these are important issues, all of them cannot be discussed in detail in a single paper. To narrow the scope of this paper, I will present the quantitative data on both debates but focus on a qualitative analysis of the technology debate.

Results

After reviewing the videotapes, I learned that the students' comments generally fell into the following categories: affirmation, clarification, disagreement, opinion, question, and request. As shown in Tables 1 and 2, the

frequency counts reveal the number of participants in each of the two debates as well as the types of responses they made. The data is partitioned to show how many statements the facilitator, the panelists and the general audience made.

However, quantitative data alone do not adequately describe what happens in educational environments. Qualitative data, such as videotapes, provide an in-depth approach that can be used for further analysis. The videotape of the technology debate was transcribed and analyzed for themes and patterns. To ensure anonymity, a single initial was used to differentiate among the speakers.

Mrs. D, an African American woman that began her college education in her forties facilitated the two debates. Mrs. D was on the dean's list and was also a recipient of an award from the College of Education for being an outstanding student. The following transcript is an excerpt from the technology debate led by Mrs. D. Periodically the time is shown in parenthesis to help the reader.

Transcript of Technology Debate

D: (00:0:00) Today we are talking about the use of technology in the classroom. Mr. Q is against technology, and Ms. R is for technology. Let R tell us why she supports technology use in the classroom.

R: Reason why I support technology in the classroom is basically because we are moving in the computer age…that's where

everyone is going, and if we don't have any knowledge on computers, kids come out of school ... will be lost and jobs and everything.... So given a strong background and their knowledge in the classroom...a computer in every classroom...at least every school should have...and this gives kids from kindergarten on up...the younger you start the better...calculators can be used as a tool for...difficult problems.... They could have it there to use.

D: Q, give us a rebuttal why students should not have technology in the classroom.

Q: We shouldn't have technology in the classroom because it becomes a crutch. Students...dependent on it rather than use it...also cost a lot of money to have a computer in every class.

D: (00:1:52) Do we have a challenge on the pro side of technology?

S: Mr. Q, how will our children be prepared for the future if they don't have technology in the classroom because a lot of children can't afford to have it in the home either?

D: Let's hear a comment from the con side.

M: Technology is just a crutch for...children. How are they supposed to learn when they have all these calculators in classrooms? They go to the grocery store, and they can't even count up how much they owe because they have...been given a calculator. (Applause.)

Q: (00:2:47) I think you have to know the basics before you get into computers. Computers do everything for you. Don't start with technology. Start with the basics.

D: How much of the curriculum should be on the basics and how much on technology?

V: (00:5:07) If we in the society have a problem providing enough textbooks for every student in a classroom because of financial problems, how are we going to provide computers? The higher class will have the computers. We would have to bridge the gap even more by providing computers. Lower kids who cannot afford the books who cannot afford the computers will be even less advantaged....

S: We are not going to be disadvantaged. I'm not saying use it as a crutch but use it as an aid...coming from a classroom without technology...we are not prepared....

A few of the students realized that the discussion was moving away from the technology issue. Some recognized that the equity issue was a subject for another debate and decided to focus on the technology issue.

C: (00:6:33) How is [a] child supposed to pass the SAT-9 or the CAT test when they cannot use calculators on the test?

E: (00:7:25) One thing this technology allows us [is] to do in microseconds what it would take minutes to do with a pencil.

L: I agree with E that students need to learn to compute fast. However, if they are allowed to use computers, it limits their ability to compute fast in their minds. If they have practice adding and subtracting, they'll be able to spit out answers like that.... They won't need a calculator. (Applause.)

D: Are you saying that we need to learn facts first without the technology? (Yes!)

E: (00:8:20) The tool of a calculator will ... allow them to do even more computing. You have to ... put stuff in the calculator before you can even get an answer. That's where ... children will be getting these skills.... That's information. If we take that information and put it with technology, we will be the bomb!

T: (00:9:07) Evidently, we are not the bomb. The [TIMSS] study that came out last week says the U. S. is last in math.

Q: The U. S. is dependent on technology. That's why we are last in math.

R: We are not letting the kids come to conclusions for themselves.... Technology is not what is corrupting us.

J: My concern about technology…is how am I going to know that a student understands what they are doing if they don't write it out on a piece of paper.

X: We are not saying that you always in every instance use computers, but you use them as often as you can…[to] be beneficial to the student.

Mrs. D was able to keep the students focused on the issue and brought the group to a consensus. After the 18-minute debate, the group agreed that technology was important, but they thought that the basics still needed to be taught first.

Discussion

Out of the 30 students enrolled in the mathematics methods course, 29 students attended class on the day of the debates. Of this number, 1 student videotaped the debates. Thus, 28 students could actually participate in each debate. The number of students that verbally participated in Debate 1 was 16 (57%). In Debate 2, the number of active participants was 22 (79%). These data show that the number of participants increased 22%, but it is unclear whether this increase can be attributed to the different topics or to the students becoming more relaxed with the debate format or both. Nevertheless, it is clear that classroom debates have the potential to pull students into discussions that develop around the issues.

Classroom debate also promotes different types of classroom discourse. During lectures, students are more likely to ask the instructor questions about the material or answer questions posed by the instructor. The data from the transcript show that the students' comments fell into six types of categories. The mean number of responses in the categories ranged from a low of 5.5 for requests for additional information to a high of 21 for opinions. Therefore, classroom debate encourages a range of many kinds of responses from students as they seek to gather information and to construct meaning for themselves.

In addition to a high-level of student involvement, the data show that classroom debate can provide instructors with valuable knowledge about students' perceptions and attitudes on important educational issues. The crux of the reform movement in mathematics education is to change what mathematics is taught and how it is taught. Using technology in the classroom and engaging children in constructivist activities have the potential to change how mathematics is taught. Such issues are of vital importance to teacher education programs. The arguments that prospective teachers raise will impact the way they teach mathematics for the next generation.

The discussion that emerged from the technology debate shows that most prospective teachers' have limited knowledge about the use of calculators and computers in the classroom. The first argument that arose revealed teachers' fear that calculator use interferes with learning basic math facts. Thus, the classroom

debate revealed misconceptions about calculator use and allowed me to address these issues in future classes. Mathematics educators can use teachers' dilemmas and misconceptions to help them to clarify misunderstandings and model teaching practices that will improve student outcomes.

The technology debate revealed my methods students' beliefs about calculator use. Most of them agreed that it should be used as a tool, but many did not know how to use that tool to children's advantage. Later in the semester, I demonstrated how calculators and computers could be used to help students solve a variety of problems. Calculators can show students how patterns can be used to solve problems that require skip-counting or constant functions. Students can check their solutions to fraction problems to see if they simplified the number to lowest terms. Students can reinforce their knowledge about converting fractions to decimals or percents. Graphing calculators can be used to find the mean, median, minimum and maximum values as well as to graph simple functions. The probability of winning the lottery can be determined and random numbers can be easily generated with these advanced calculators. Computer software allows students to enter data on a spreadsheet and keep track of the results. I was also able to show many more uses for technology besides finding answers to simple computation problems.

As a result, the students in my course were exposed to the "mathematical power" that technology could unleash. Developing process skills is critical to

understanding and successfully solving problems in mathematics. Teachers cannot rely on technology alone but must provide opportunities for students to explain their reasoning.

The calculator may give the correct answer, but students must first know what problem needs to be solved. Does the problem require that they add, multiply, subtract or divide? Decoding what the problem requires is the first task that students must attend to. Teachers can facilitate classroom discourse to help students learn how to solve problems. Using calculators can take the pressure off students and help them to focus on what to do rather than getting an answer.

Another benefit of classroom debate is that students learn how to engage in the development of convincing arguments about educational issues. Additional data obtained from the students' written responses to the debate show that some of the students were uncomfortable arguing for a position they did not personally believe in. However, they admitted that developing constructive arguments helped them to understand all sides of the issue. They believed that this skill would help to equip them for parent conferences. Parents are often confused about the mathematics reform movement. They learned mathematics the "traditional way," and those who were successful in that context do not see a need for their children to learn mathematics differently (Kronholz, 1997). It is important for teachers to listen to parents, but they should also be able to articulate reasons why they teach the way they do, constructivist or otherwise.

Finally, classroom debate allows students to learn important lessons in democracy. Fruitless argument for the sake of argument itself is not a desirable outcome. Mrs. D was an excellent facilitator. She stayed away from disagreeing with the panelists and the audience, often paraphrased students' ideas and asked how the group might arrive at some consensus. Learning to compromise and finding the middle ground are skills that will enable prospective teachers to discover a pedagogy that works for them.

Conclusion

The level of student interaction is a strong predictor of academic achievement (Cohen & Lotan, 1995). This teacher-research study shows that the kinds of processes reformers recommend, such as engaging students in meaningful discussions, has the potential to create opportunities for a high-level of involvement. Although this study is limited to one class of pre-service teachers, the implications are that the debate model is a powerful tool capable of revealing students' attitudes and biases about educational issues. Instructors can use this knowledge to address misconceptions and thus, attempt to influence pre-service teachers to implement reforms they may otherwise be unwilling to try.

Classroom debate offers students one forum in which to interact and exchange ideas. In order for prospective teachers to learn the power of classroom discussion, instructors need to provide opportunities for this activity to be modeled in methods courses. Changing the way mathematics is taught has to

begin with teachers. Change occurs more readily and has the potential to be permanent if it occurs in learning communities where pre-service teachers can weigh the alternatives and choose to become producers instead of consumers of knowledge.

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Table 1

Level of Student Participation in Technology Debate (n = 28)

Student Roles	Participants	Affirmation	Clarification	Disagreement	Opinion	Question	Request
Facilitator	1	5	7	0	0	4	4
Panelists	2	0	4	2	8	0	0
Audience	13	8	7	7	13	4	1

Table 2

Level of Student Participation in Constructivism Debate (n = 28)

Student Roles	Participants	Affirmation	Clarification	Disagreement	Opinion	Question	Request
Facilitator	1	2	4	0	0	6	2
Panelists	2	0	5	2	8	2	4
Audience	19	3	10	6	13	6	0